

REMARKS

Reconsideration and allowance of this application are respectfully requested in view of the above Amendment and discussion below.

Applicants' invention concerns a multiple phase AC electric machine with semiconductor switches electrically insulated from heat sinks and, in turn, the heat sinks are grounded to the housing and thermally separated for each phase of the machine. Prior art devices of this type were often mounted close to the engine and exposed to extreme thermal conditions and thus there was a need to increase cooling capability as well as reduce temperature variance. Furthermore, when used with hybrid vehicles, power supply voltages are higher than conventional gasoline only vehicles and the demand for electrical insulation of high voltage devices is increased. The present invention solves this problem by a multi-phase AC machine which eliminates temperature variance among multiple devices, completely insulates high voltage devices from ground, and has an appropriate configuration suitable for semiconductor switches of the normal types being used such as MOSFET, IGBT, etc.

According to the presently claimed invention, switching device packages 16 are fixed to the heat sinks so that heat can be conducted but are electrically insulated from the heat sinks. These switching device packages 60 are each electrically insulated from the prospective heat sinks 18 and the heat sinks are grounded to the rear housing 11 through the rear cover 13, as discussed in the specification at page 12, lines 18-23, for example.

Independent claims 1 and 2 each recite the above-discussed features which define the present invention over the prior art. These claims 1 and 2 have been rejected under 35 U.S.C. §102 as unpatentable over Sunaga et al. (U.S. Patent No.: 6,661,134) in view of Franz et al. (U.S. Patent No.: 4,161,775) as indicated at item 1 on pages 2-4 of the patent Office Action.

Dependent claims 3-6 have been rejected over the combination of the above two references and further in view of Kershaw (U.S. Patent No.:

5,818,1333) and claims 7 and 8 have been rejected over the combination of the above references and further in view of Suzuki (Japanese Patent No.: 410209357).

Applicants respectfully submit that independent claims 1 and 2 define structure not shown, disclosed, or made obvious by the references or any of their obvious combinations to one of ordinary skill in the art.

The reference to Sunaga et al. concerns a motor having an improved brushless configuration with switching devices 41 in pressed contact with the irradiating portion 71 of the heat sink 20 through the structure of the pressing member 60. In the statement of the rejection, the Examiner has indicated that Sunaga et al. discloses that the heat sink 70 is grounded to the housing 21 in Figure 1. Applicants respectfully submit that there is no disclosure in Sunaga et al. that the heat sink 70 is grounded. Column 3, lines 2 and 3 of Sunaga et al. indicate that "the circuit protection case 20 made of resin . . .". Therefore, the circuit protection case 20 including the items 21 and 22 is an insulator based on the resin structure. Thus, in Sunaga et al. there is no teaching or suggestion concerning the restrictions of the shape and the size of the heat sink as a result of increase in semiconductor voltage capacity or addressing the problem of short circuit between the positive heat sink and ground caused by metallic debris. There is also no indication of preventing an operator from receiving an electrical shock as a result of use of a multi-phase alternating-current rotational electrical machine. Further, there is no suggestion of the claimed invention whereby semiconductor devices are electrically insulated from the heat sinks and wherein the heat sinks are grounded to the housing.

The secondary reference to Franz et al. (U.S. Patent No.: 4,161,775) discloses an electrical machine structure with a semiconductor switching device separated in each phase. However, there is no disclosure that the heat sink is grounded to the housing and therefore even if it is assumed for purposes of argument that the reference to Franz can be combined with Sunaga for the purpose of having a semiconductor switching device separated in each phase,

there is no teaching in either of the references concerning the heat sink being grounded to the housing and of the electrical insulation of the semiconductor devices from the heat sinks.

Claim 1 has been amended to more clearly recite that there are heat sinks fixed to respective semiconductor switching devices and that the semiconductor switching devices are electrically insulated from the heat sinks and that the heat sinks are grounded to the housing as well as thermally separated in each phase. Independent claim 2 recites that the temperature of the multiple semiconductor switching device are substantially determined in each phase. Additionally, claim 2 also recites that the switching devices are electrically insulated from the heat sinks and that the heat sinks are grounded to the housing and that the heat sinks are fixed to respective semiconductor switching devices so that heat can be conducted.

The references to Kershaw and Suzuki '357, even accepting the statement of the rejection for their showing with respect to dependent claims 3-6 , 7 and 8 respectively, add nothing toward meeting the claim limitations of independent claims 1 and 2 from which these claims ultimately depend and contain all of the limitations thereof.

Applicants have added new dependent claims 9 and 10 which respectively depend from independent claims 1 and 2. The subject matter of claims 9 and 10 is fully supported by the originally filed specification and, based on their dependency on independent claims 1 and 2, are also submitted as being patentable.

In summation, the invention defined by independent claims 1 and 2 provides that, as discussed in the specification at page 13, lines 3-12, it is not necessary to insulate the positive heat sink from the housing (earth) thereby avoiding restrictions to the size and shape of the heat sink as the semiconductor device voltage capacity increases. Additionally, there is no possibility of a short circuit between the externally exposed positive heat sinks 18 UH, 18 VH and 18 WH and earth caused by metal debris or of an operator receiving electrical shock.


Therefore, in view of the distinguishing features between the claimed invention and the references which features are not shown or disclosed or made obvious by the references or their combination, Applicants respectfully request that this application containing claims 1-10, including independent claims 1 and 2, be allowed and be passed to issue.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #056208.52669US).

Respectfully submitted,

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